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LIFE-HISTORIES OF INDIAN INSECTS

DIPTERA: *SPHYRACEPHALA HEARSEIANA*, WESTW

BY

S. K. SEN, B.Sc

Entomological Assistant, Pusa

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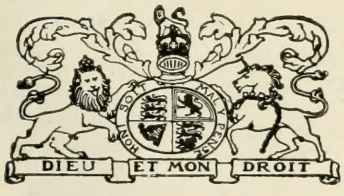

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LIFE-HISTORIES OF INDIAN INSECTS.

DIPTERA: *SPHRYRACEPHALA HEARSEIANA*, WESTW.

BY

S. K. SEN, B.Sc.,

Entomological Assistant, Pusa.

[Received for publication on 27th April 1921.]

It is interesting that Linnæus terminated his zoological labours by the publication of "Dissertatio Entomologica, bigas insectorum sistens," namely, *Paussus* and *Diopsis*, and that Williston has given the place of honour to a member of the family of Diopsidæ by making it the frontispiece in his standard work on North American Diptera.

The chief interest of this family arises from the singular eye-stalks, and on these Westwood's remarks are of interest: "At first sight these horns might easily be mistaken for antennæ; but they are inarticulated at the base as well as along the surface; they have, therefore, no independent motion, their movements being necessarily accompanied by those of the whole head; when, however, we recollect that they contain not only the infinity of nerves of the compound eyes at their extremities, but also those producing the sensation of which the antennæ are the seat, we can easily imagine how necessary it is that the means of communication should be unbroken by articulations." [1]

Say, in 1817, discovered a single specimen of the American species *Sphryracephala brevicornis* on skunk cabbage (*Pothos fœtida*), and afterwards found it in profusion in crevices of rocks on the banks of the Missouri. Fitch also collected it on skunk cabbage. But Aldrich observes: "In midsummer

[1] *Trans. Linn. Soc.*, Vol. XVII, 1837, p. 283. In the same paper Westwood lists some Crustaceans, an Arachnid, and the fish *Squalus zygæna*, Linn., all of which possess stalked eyes He, however, does not offer any opinion as to the function of these eyes.

of 1901 I found this species by hundreds on foliage in one of the shady glens adjoining the campus of Cornell University, Ithaca. There is nothing to show that the larva has anything to do with the skunk cabbage."[1] Aldrich refers to Houghton as having published a "Note on the habits of the adult," in the *Ent. News*, XIII, but this issue of the Journal is not available. Gray figures the species in Griffith's Translation of Cuvier's *Règne Animal* (1844, p. 774, pl. 62), but does not say anything about the habits of the adult.

Lt.-Colonel Sykes, F.R.S., writes as follows respecting the habits and habitat of *Diopsis* (*Teleopsis*) *sykesii*:—

"*Habitat.* The hill fort of Hurreechunderghur in the Western Ghats of the Deccan, at an elevation of 3,900 feet.....The insect affects chasms or ravines in the lofty woods which encircle the mountain in belts in various places. Where the sunbeams occasionally pierce the woods and fall upon isolated or salient rocks in the above localities, they are seen in myriads, either poising themselves in the rays, or reposing on the spots on which the rays fall."[2]

Colonel Hearsey reports having captured *S. hearseiana* "in different months and various localities; some on window-panes in June, some on orange and citron leaves in gardens in July, and some in the middle of August on cucumber leaves. He further states that they appear to feed either on the sweet deposit of the Aphis, or on the Aphides themselves" (*Proc. Entom. Soc. Lond.*, Jan. 1, 1844, pp. 82-83; Westwood remarks that "Colonel Sykes's observations on the predaceous habits of *D. sykesii* might lead to the opinion that it was upon the Aphides themselves that the *Diopsis* feeds").

Brunetti records having found *S. hearseiana* "in profusion, within the space of a few days, under a low arch over a roadside ditch in Cawnpur about 30th November 1904 and also in the old Residency at Lucknow 4th December 1904 (*Journ. and Proc. Asiat. Soc. Bengal, New Series*, Vol. XIV (1918), No. 9, p. cclxix).[3] Mr. Bainbrigge Fletcher also found *S. hearseiana* "in profusion at Nagpur on 18th December 1919 settled in masses on leaves of bushes overhanging a small jungle stream below the Telinkheri tank." [Since this Memoir has been sent to the Press, I have come across another case on 10th June 1921, below Kasauli, at an elevation of about 5,000 feet, where I found on the shady face of a rock overhanging a pool in the bed of a stream (at that time nearly dried up) a black mass, several feet square, composed of countless individuals of *S. Hearseiana*. On passing

1 Aldrich. *A Catalogue of North American Diptera*, 1905, p. 623.

2 *Trans. Linn. Soc.*, Vol. XVII, 1837, p. 311.

3 Brunetti refers to the same observations in his "Notes on Oriental Diptera" in which he also publishes a list of the oriental species of Diopsinæ (*Rec. Ind. Mus.*, Vol. I, Part II, Aug. 1907, pp. 163—166).

Explanation of Plate IV.

Sphyracephala hearseiana, Westw.

Fig. 1. Egg. ×20.

„ 2. First larval instar. ×20.

„ 3. Last larval instar. ×20.

„ 3 (*a*). Jaws of last larval instar (dissected out after being treated with lactic acid).

„ 3 (*b*). Posterior spiracle of last larval instar (dissected out after being treated with lactic acid).

„ 4. Pupa. ×20.

Figs. 5, 5 (*a*) and 5 (*b*) show the gradual development of the eyes and the formation of their pigment. In 5 (*b*) the portion bearing the eyes has been removed from the puparium.

Fig. 6. Adult. ×15.

„ 6 (*a*). Wing.

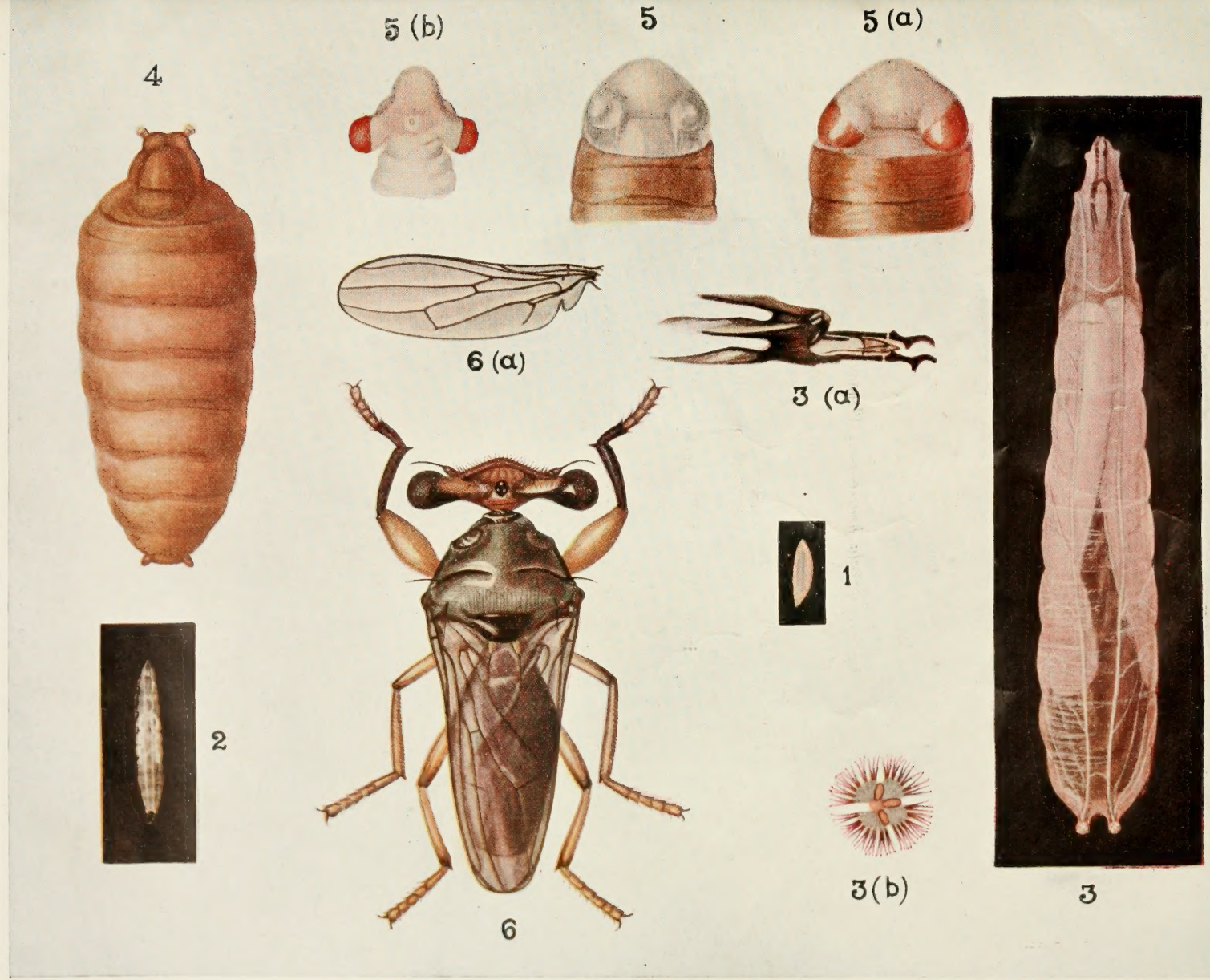

PLATE IV.

SPHRYRACEPHALA HEARSEIANA, WEST W.

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a net over them they rose with a roar like a swarm of bees and a solid mass of several handsful of flies was got in the net. Apparently the flies were originally congregated in a mass several individuals (? several inches) deep. The mass consisted of flies of both sexes, in approximately equal numbers. Major Christophers tells me that he has seen the same thing before near Kasauli, on a rock near a stream. The reason for such massing is not very evident, especially if these flies are really predaceous.—T. Bainbrigge Fletcher.]

At Pusa *S. hearseiana* has been found in hundreds congregated on the ceiling of culverts near roadside drains and also, in one instance, on the walls of a large recess amongst the branching roots of an old banian tree overhanging a large drain(Pl V). Year after year they have been noticed on those same spots, doing nothing in particular, except frequently moving their forelegs and leading a characteristically gregarious existence. This year (1921) a swarm of these flies was observed sitting on the ceiling of a culvert during the last week of February (they must have settled there much earlier), but not a single one could be found, when searched for, after the first week of April. (Presumably they fly away to more protected localities when strong winds begin to blow at Pusa.)

These insects are disturbed even by a gentle wave of the human breath and appear to be very susceptible to artificial light when focussed on them from an electric lamp, at night, gradually walking away in masses, but never taking to flight. When enclosed in cages they appear to be positively heliotropic.

Dalman considered "that insects with prominent eyes affected moist situations," while his supposition that the insects were predaceous in habits, would seem to be correct in view of the developed structure of the mouth, the raptorial forelegs and the exaggerated distance between the eyes. There is little doubt that the members of this family are inhabitants of moist situations, as the observations referred to above would seem to indicate. But examination of vegetation or of earth dug out from the places inhabited by them failed to reveal any of the early stages. Nor do we seem to have any definite record that these flies are actually predaceous in the adult stage.

The generic position of *Sphyracephala hearseiana* does not appear to be quite clear. Say founded the genus on the insect first called by him *Ichias brevicornis ;* but he had noted its affinity to *Diopsis*, and afterwards gave it the generic name *Sphyracephala*, distinguished from *Diopsis* by the shortness of the eye-stalks and by having the "antennæ inserted *in front*, the third joint

rounded and compressed and setigerous at the tip."[1] But in *hearseiana*, although the ocular peduncles are short, the antennæ certainly do not appear to be inserted "in front," nor is the third joint compressed. Williston's description of the family of Diopsidæ, in *North American Diptera*, is confined only to *brevicornis*, and as such, his description is more of a specific nature. Bigot, however (*Annales*, 1880, 90--94), though retaining Say's original statement in so far as regards the length of the ocular peduncles, assigns[2] to *Sphyracephala* the generic character of the antennæ being inserted *on the ocular peduncles*—a character which is also true of the Indian genus *Teleopsis* which, however, can be at once distinguished by its long and slender eye-stalks and spined thorax.

The references which Van der Wulp quotes[3] as giving the specific characters of *S. hearseiana* are Westwood's original description[4] and Macquart's *Diptères Exotiques* (Supp. 4, 1850, p. 297).[5] Macquart, after considering Westwood's description, prefers to regard the species as belonging to *Diopsis*, noting, however, that in one important respect it differs from *Diopsis*, namely, in the absence of thoracic spines. Westwood describes the species thus (*Proc. Ent. Soc. Lond.*):—

"*Diopsis hearseiana*, W.—Short, robust, the head fulvous, varied with black; ocular peduncles short and thick, black at the tips; thorax greyish-black, with a short spine on each side beneath the base of the wings, and two others, whitish and terminated by long hairs; the abdomen black glossy; the legs flavescent, with the fore femora marked with fuscous on the inside, the fore tibiæ black; wings hyaline.

"Length of the body 2 lines; expansion of the wings 4 lines."

As, except Macquart's and Westwood's somewhat incomplete account of the insect, no other description is available for reference, the following characters of the species are given:

Black; head brown, with two black lines running between the antennæ and forming an eye-shaped space; antennæ yellow, three-jointed and setigerous

[1] *American Entomology*, Vol. III, in which Say published his description of the genus, is not available, and the portion under quotation is taken from Westwood who apparently copied it from Say. It may be mentioned that Wiedemann, Say's contemporary, places the species under *Diopsis* (*Auss. Zw.*, II, 1830, p. 563).

[2] A course which tends to exclude *brevicornis* from the Genus.

[3] *Diptera from South Asia*, 1896.

[4] *Proc. Ent. Soc. Lond.*, Jan. 1, 1844, pp. xcix—c, pp. 82--83 of reprint (1864); *Cab. Oriental Entom.*, 1848, p. 37, pl. 18, fig. 4.

[5] Macquart figures this species, but his illustration is much too primitive to allow of any of the important diagnostic characters being recognized, except, of course, the ocular peduncles: even the spines on the scutellum are wanting.

A group of *S. hearseina* congregated on the walls of a large recess amongst the branching roots of a *banyan* tree at Pusa.

at the tip ; eye-stalks short and stout ; front setose ; ocelli fairly prominent, with a seta on each side ; a seta on each side of the thorax ; pronotum with an anterior collar and two small lateral lobes ; mesonotum with two lateral lobes at the anterior end ; a short spine on each side beneath base of wings ; scutellum with two yellow setigerous spines, anterior femora thick, yellow ; anterior tibiæ black, slightly curved, and armed with a row of small spines ; intermediate and posterior legs yellow, with black at tips of femora and tibiæ ; tarsi five-jointed ; first article of anterior tarsi black ; abdomen with all the segmental joints not clearly marked ; wings clear and hyaline, the venation being of the Ortalid pattern with the auxiliary vein approximated to the first longitudinal vein.

Length 5 mm.; distance between distal ends of eyes 2 mm.

In confinement these insects seem to require an excess of moisture, decaying vegetation and a cool shady place. (No eggs could be obtained from the batch of insects confined in cages kept in broad daylight.)

Earth, about one inch thick, was laid over the bottom of a small glass aquarium, a large quantity of grass was spread over it, and the earth and the grass were copiously wetted with water, taking care that a fair quantity of the water was left in excess after being soaked in by the earth. Sugar solution was supplied to the insects in a watch glass, and the aquarium was left covered in a shady place, its contents being moistened daily, and sugar solution supplied at intervals.

The insects readily paired, and eggs were found about the tenth day. The average incubation period was about four days, larval period seven days and pupal ten days. As eggs were not obtained when the insects were kept singly, the number of eggs laid by one individual is not known.

The eggs, which are laid scattered on grass blades, are less than 1 mm. in length, plano-convex and creamy white in colour, with one end broader than the other and without any characteristic ornamentation. In some cases, eggs were found to retain their viability even when kept under water for three weeks, the larvæ hatching out soon after removal of the eggs from water. The larva, soon after it hatches out, measures 1·2 mm. in length and 0·2 mm. in breadth, and consists of twelve segments, with somewhat convoluted fat bodies, and with the jaws appearing as two black specks. When full-grown, the larva measures about 6 mm. × 1 mm., and assumes a creamy white colour due to the very large amount of fat body which obscures many of its structural details. The anal spiracles are now displayed as two protuberances which, when dissected out after being treated with lactic acid, are seen to consist of three stigmatic plates of brown colour imbedded in semi-transparent chitinous matter which

sends out branched filaments, indicating the semi-aquatic life of the larva, the elongated chitinous protuberances presumably allowing of the respiratory function being carried out, without its being drowned, when placed in semi-aquatic conditions. The tracheal tubes terminate anteriorly at the end of the second segment. The jaws appear as a double process, bridged in the middle by means of a loop, the chitinous articulations of the jaws being shown in Pl. IV, fig. 3(*a*). The larvæ feed on decaying vegetation, quickly hiding away within the folds of grass-blades, when exposed to light. The larvæ seem to require an excess of moisture : if kept in a desiccated condition, they quickly dry off.

The puparium at first appears yellowish white, gradually turning into mahogany brown, the posterior spiracles of the larva now appearing as two projecting tubercles at the posterior end of the puparium. Except for a gradual broadening towards its anterior end, no indication of the ocular peduncles is noticeable on the puparium. The position and gradual development of these remarkable eyes are shown in Pl. IV, figs. 5, 5(*a*) and 5(*b*). The pupa does not appear to be damaged if kept submerged for a fairly long period, but on being kept in a desiccated condition the contents of the puparium have, in several instances, been seen to dry up. The mode of emergence of the adult is like that of flies belonging to the Cyclorrhapha generally, the characteristic ptilinal sac being well exhibited in the figures last referred to.

As Williston states, "the habits, whether of the adults or larvæ [of *S. brevicornis*], are not known, nor are they known of any other member of the family." The present paper, therefore, probably for the first time, gives an account of the early stages of a member of this family.

The above observations on the life-history of this insect were made at Pusa in March.